

Atty. Docket No. PIA31071
Serial No: 10/750,489

Remarks

Applicant and his representatives wish to thank Examiner Lee for the thorough examination of the present application, the explanations in the Office Action dated May 22, 2006, and the helpful and courteous telephone discussions held on August 17, 2006. The following remarks shall summarize and expand upon topics discussed

The present invention relates to a method of fabricating an MIM capacitor of high capacitance in a semiconductor device. The method (as set forth in Claim 1) generally includes the steps of (a) depositing an interlayer dielectric film on a metal line, (b) etching the interlayer dielectric film to form an MIM capacitor forming region, (c) sequentially depositing a lower electrode layer comprising TiN, an insulator layer and an upper electrode layer on the interlayer dielectric film, (d) etching the lower electrode layer, the insulator layer and the upper electrode layer to form an MIM capacitor, wherein a capacitance of the MIM capacitor is determined by controlling a thickness of the interlayer dielectric film.

In another embodiment, the method (as set forth in Claim 7) generally includes the steps of (a) depositing an interlayer dielectric film on a metal line; (b) planarizing the interlayer dielectric film, (c) etching the interlayer dielectric film to form an MIM capacitor forming region, (d) sequentially depositing a lower electrode layer, an insulator layer and an upper electrode layer on the interlayer dielectric film, and (e) planarizing the lower electrode layer, the insulator layer and the upper electrode layer by an etch back process to form an MIM capacitor, wherein a capacitance of the MIM capacitor is determined by a thickness of the interlayer dielectric film.

The references cited against the claims (Rasmussen, U.S. Patent Application Publication No. 2004/0262658, and Lopatin, U.S. Patent No. 6,433,379) neither disclose nor suggest depositing a lower electrode layer comprising TiN (see Claim 1). Furthermore, the cited references neither disclose nor suggest planarizing the lower electrode layer, the insulator layer, and the upper electrode layer by an etch-back process (see Claim 7). Consequently, the present claims are patentable over the cited references.

Atty. Docket No. PIA31071
Serial No: 10/750,489

The Rejection of Claims 1, 3, 5-7, 9-13 and 16-24 under 35 U.S.C. § 103(a)

The rejection of Claims 1, 3, 5-7, 9-13 and 16-24 under 35 U.S.C. § 103(a) as being unpatentable over Rasmussen in view of Lopatin et al. is respectfully traversed.

Rasmussen discloses a method of forming an MIM capacitor, with a lower electrode made of osmium (Os), platinum (Pt), rhodium (Rh), ruthenium (Ru), palladium (Pd), or iridium (Ir) (see, e.g., Rasmussen, page 4, paragraph [0042]), but is silent with respect to a lower electrode made of TiN as recited in independent Claim 1. Furthermore, Rasmussen is silent with respect to planarizing the lower electrode layer, the insulator layer, and the upper electrode layer, as recited in independent Claim 7. Thus, Rasmussen fails to teach or suggest all of the limitations of independent Claims 1 and 7.

Lopatin fails to cure the deficiencies of Rasmussen with respect to the present Claims. Lopatin discloses a method of fabricating an MIM capacitor, with a lower electrode comprising titanium, zirconium, aluminum, niobium, tungsten, chromium or copper (see, e.g., Lopatin, col. 4, lines 62-64), but is silent with respect to a lower electrode comprising TiN. Thus, *no possible combination of* Rasmussen and Lopatin can disclose or suggest all of the limitations of independent Claim 1. Therefore, independent Claim 1 (and all claims dependent therefrom) are patentable over Rasmussen in view of Lopatin.

The Office Action dated May 22, 2006 appears to acknowledge that neither Rasmussen nor Lopatin discloses a lower electrode comprising TiN (see page 2, last paragraph, of the Office Action). The Office Action asserts that it is within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice (see page 3, first paragraph, of the Office Action). However, this assertion begs the questions: From whose intent is the intended use drawn? How is suitability for the intended use determined?

Certainly, neither Rasmussen nor Lopatin et al intended to use TiN as a lower electrode. Thus, the selection of TiN for use as a lower electrode could have only been "intended" by the

Atty. Docket No. PIA31071
Serial No: 10/750,489

present inventors. In fact, Rasmussen explicitly discloses use of TiN for a different layer, providing arguably different function(s), from a lower electrode of a capacitor (see paragraph [0033]). It would seem that if Rasmussen intended to include TiN in the list of lower electrode materials, Rasmussen could have easily done so. Given that Rasmussen devotes considerable text to discussing titanium nitrides (see, e.g., paragraphs [0033]-[0035] and [0038]), it should have been a relatively simple exercise for Rasmussen to include TiN in the list of metals suitable for the lower electrode if Rasmussen thought TiN would be suitable for such use. If anything, by discussing titanium nitrides at such length, but not reciting TiN in the list of lower electrode materials, one can reasonably infer that Rasmussen did not intend to include TiN in the list of lower electrode materials. It seems that the "intent" behind the selection of TiN for the intended use is the intent of the inventors, as disclosed in the present application.

Furthermore, no disclosure or teaching in either cited reference is relied upon to support an assertion that one skilled in the art would know that TiN is suitable for use as a lower electrode in a capacitor. The assertion that any electrode material (including the claimed material TiN) would work equivalently to any other well-known electrode material assumes that TiN is known as an electrode material and appears to be unsupported by the art relied upon for the rejection. The knowledge TiN is suitable as an electrode material appears to come only from the present application. As a result, it appears that the present disclosure is being read into the cited references, and one of ordinary skill in the art is being given knowledge that appears to come only from the present application.

There must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make a claimed combination. That knowledge cannot come from the applicant's invention itself. *In re Oetiker*, 977 F.2d 1443, 1447; 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992); citing *Diversitech Corp. v. Century Steps, Inc.*, 850 F.2d 675, 678-79, 7 USPQ2d 1315, 1318 (Fed. Cir. 1988); *In re Geiger*, 815 F.2d 686, 687, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987); *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1147, 227 U.S.P.Q. 543, 551 (Fed. Cir. 1985). In this case, no cited reference discloses an electrode

Atty. Docket No. PLA31071
Serial No: 10/750,489

comprising TiN. Thus, the knowledge to combine a lower electrode comprising TiN with the remaining elements of Claim 1 could have come only from the present application.

To assert that one of ordinary skill in the art would know to select a particular material for a use intended only by the present inventors based on suitability disclosed only by the present inventors, without any disclosure, teaching or suggestion in the references to do so, is a classic hindsight reconstruction of the invention. One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the cited references to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 1075, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988); see also *In re Pleudemann*, 910 F.2d 823, 828, 15 U.S.P.Q.2d 1738, 1742 (Fed. Cir. 1990); and *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 1051, 5 U.S.P.Q.2d 1434, 1438 (Fed. Cir. 1988). To use the patent [application] as a guide through the cited references, combining the right disclosures in the right way to arrive at the result of the claimed invention, is improper. See, e.g., *Medtronic, Inc. v. Daig Corp.*, 611 F. Supp. 1498, 1534, 227 U.S.P.Q. 509, 535 (D. Minn. 1985), *aff'd* 789 F.2d 903, 229 U.S.P.Q. 664 (Fed. Cir. 1986).

Therefore, the rejection of Claim 1 (and all claims depending therefrom) is legally unsustainable, and should be withdrawn.

With regard to Claim 7, Lopatin further discloses that the lower electrode layer, the insulator layer and the upper electrode layer may be planarized by a CMP process (see, e.g., col. 7, lines 2-7), but is silent with respect to an etch-back process. The sections of Lopatin that disclose etching (col. 2, ll. 18-20; col. 3, ll. 62-64; and col. 4, ll. 3-10) do not appear to concern an etch-back process. Tellingly, when Lopatin describes the process, the capacitor electrodes are planarized by CMP (see col. 7, ll. 2-9, and FIGS. 8-9). Thus, the combination of Rasmussen and Lopatin does not disclose or suggest all of the limitations of independent Claim 7.

As discussed above, under 35 U.S.C. § 103, there must be some reason, suggestion, or motivation *found in the prior art* whereby a person of ordinary skill in the field of the invention would make a claimed combination (in this case, combining the step of planarizing the lower electrode layer, the insulator layer and the upper electrode layer by an etch back process with the

Atty. Docket No. PLA31071
Serial No: 10/750,489

other steps recited in Claim 7). That knowledge cannot come from the applicant's invention itself.

In the present case, the knowledge to combine planarizing by an etch back process with the remaining steps of Claim 7 could have come only from the present application. As discussed above, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the cited references to deprecate the claimed invention. To use the patent application as a guide through the cited references, combining the right disclosures in the right way to arrive at the claimed invention, is improper.

Accordingly, the rejection of Claim 7 (and all claims depending therefrom) under 35 U.S.C. § 103(a) as being unpatentable over Rasmussen in view of Lopatin is unsustainable, and should be withdrawn.

Conclusions

In view of the above remarks, all bases for objection and rejection are overcome, and the application is in condition for allowance. Early notice to that effect is earnestly requested.

If it is deemed helpful or beneficial to the efficient prosecution of the present application, the Examiner is invited to contact Applicant's undersigned representative by telephone.

Respectfully submitted,



Andrew D. Fortney, Ph.D.
Reg. No. 34,600

THE LAW OFFICES OF ANDREW D. FORTNEY, PH.D., P.C.

THE LAW OFFICES OF
ANDREW D. FORTNEY, PH.D., P.C.
401 W. FALLBROOK AVE., SUITE 204
FRESNO, CA 93711